

MARSHALL UNIVERSITY
DEPARTMENT OF MATHEMATICS
STUDENT INFORMATION SHEET AND SYLLABUS

Course Title/Number	STA 345 – Applied Probability & Statistics
Section	102
CRN	4040
Semester/Year	Fall 2018
Days/Time	TR 9:30 - 10:45 AM
Location	SH 514 (Smith Hall)
Instructor	Dr. Avishek Mallick
Office	SH 743C
Phone ext.	304-696-3443
E-Mail	mallicka@marshall.edu
Office/Hours	MWF 10:00-11:00 AM TR 2:00-3:00 PM and by appointment.
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to www.marshall.edu/academic-affairs and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

Course Description and Objectives

Statistical methods in scientific/engineering research, with emphasis on applications. This course will address probability modeling, statistical analyses, estimation and hypothesis testing procedures, regression, and analysis of variance (ANOVA). Practical applications will be implemented using the R statistical programming language. Students are free to use any other statistical package should they prefer. However, the instructor will not be able to offer software support for other packages.

Required Texts and Other Materials

Jay L. Devore (2009): Probability and Statistics for Engineering and the Sciences, 8th Ed., Brooks/Cole. ISBN – 10: 0-538-73352-7; ISBN – 13: 978-0-538-73352-6.

An Introduction to R - Notes on R: A Programming Environment for Data Analysis and Graphics. This text is available online upon downloading the R package. It is intended to guide you on the implementation of statistical analysis with R and NOT meant to substitute for the textbook or studied with the aim to become an expert in R implementations.

Calculator: You will need a calculator. It is recommended that you use a TI-83/TI-83 plus or similar graphing calculator. You are not allowed to use your phone, iPad, laptop, etc. as a calculator on any quiz or exam.

MUOnline: Grades and other course materials will be posted regularly on MUOnline.

The table below shows the following relationships: How each student learning outcomes will be practiced and assessed in the course.

Course Student Learning Outcomes	How students will practice each outcome in this Course	How student achievement of each outcome will be assessed in this Course
Students will select and produce appropriate graphical, tabular, and numerical summaries of the distributions of variables in a data set. Summarize such information into verbal descriptions.	Students are required to participate in class discussions, intensive reading of relevant chapters, and most importantly, practice numerous exercises that are available at the end of every chapter of the recommended textbook.	Homework assignments, quizzes and exams.
Students will summarize relationships in bivariate data using graphical, tabular, and numerical methods including scatter plots, correlation coefficients, and least squares regression lines.	Students are required to participate in class discussions, intensive reading of relevant chapters, and most importantly, practice numerous exercises that are available at the end of every chapter of the recommended textbook.	Homework assignments, quizzes and exams.
Students will be able to construct a model for a random phenomenon using outcomes, events, and the assignment of probabilities. Use the addition rule for disjoint events and the multiplication rule for independent events.	Students are required to participate in class discussions, intensive reading of relevant chapters, and most importantly, practice numerous exercises that are available at the end of every chapter of the recommended textbook.	Homework assignments, quizzes and exams.
Students will be able to identify the appropriate statistical procedure for analyzing data.	Students are required to participate in class discussions, intensive reading of relevant chapters, and most importantly, practice numerous exercises that are available at the end of every chapter of the recommended textbook.	Homework assignments, quizzes and exams.
Students will be able to implement appropriate statistical procedure, with and without computer software.	Students are required to participate in class discussions, intensive reading of relevant chapters, and most importantly, practice numerous exercises that are available at the end of every chapter of the recommended textbook.	Homework assignments, quizzes and exams.
Students will be able to interpret statistical computer output and to report statistical results in a clear and coherent form.	Students are required to participate in class discussions, intensive reading of relevant chapters, and most importantly, practice numerous exercises that are available at the end of every chapter of the recommended textbook.	Homework assignments, quizzes and exams.

Course Requirements

Pre-requisite: Grade C or better in either MTH 230 or IST 230, or by permission.

Computer requirement: There are many statistical packages and you are free to use any that you find applicable. You are encouraged to use the Computer Lab in SH 532. There are other computers laboratories on the campus. RStudio, an open source, powerful and productive user interface for R runs on many machines on the campus. Students will be introduced to the R-package. The SAS software is also installed on campus computers for those who would like to use SAS.

Downloading R: The R package is available for download from <https://www.r-project.org/> through any preferred CRAN mirror.

Quiz: Quizzes will be given every other week. Any unexcused absence on the day of a quiz will result in a score of zero.

Attendance Policy

Students are expected to attend all scheduled classes. It is the student's responsibility to find out what was discussed in a missed class. Although, attendance records will not be used to compute grades, missing classes can be expected to significantly reduce your chances of success. Note also that it is the student's responsibility to present approved notice of any absence that would be excused under the terms and regulations stipulated by the university.

Student behavior

Students are advised to turn their cell phones and other noise generating devices off prior to entering the class. In the case where a student awaits any emergency call, the noise should be restricted and made personal. And in this case, I should be notified as soon as the student enters the class. Food items, apart from water or soft drink, are not allowed in the class. The reading of newspapers and other unrelated materials while the class is in session is prohibited. Please ensure that other students are respected.

Grading Policy and Exam dates

All tests will be given during the regular class sessions. For makeup tests, please see the university's policy on excused absences. The final grade will be based on the following components:

2 Regular Exams	200 points
Quizzes	100 points
<u>Final Examination</u>	<u>100 points (Comprehensive)</u>
Total	400 points

The semester grade will be based on the percentage of the 400 total possible points, using the following scale:

90 -100% = A 80 - 89% = B 70 - 79% = C 60 - 69% = D 00 - 59% = F

EXAM I : Thursday, October 4, 2018 (tentative)
EXAM II : Thursday, November 15, 2018 (tentative)
FINAL EXAMINATION : Tuesday, December 11, 2018 [8:00 – 10:00 AM]

Course Topics/ Course Schedule

Weekly Teaching Guide

NOTE: The following is a tentative instructional schedule, and is subject to changes as class progresses, depending on the coverage status of the contents:

Chapter 1: Overview and Descriptive Statistics [1.5 Weeks]

- 1.1 Populations, Samples, and Processes
- 1.2 Pictorial and Tabular Methods in Descriptive Statistics
- 1.3 Measures of Location
- 1.4 Measures of Variability

Chapter 2: Probability [1.5 Weeks]

- 2.1 Sample Spaces and Events and Set Theory
- 2.2 Axioms, Interpretations, and Properties or Laws of Probability
- 2.3 Counting Techniques
- 2.4 Conditional Probability
- 2.5 Independence

Chapter 3: Discrete Random Variables and Probability Distributions [2 Weeks]

- 3.1 Random Variables
- 3.2 Probability Distributions for Discrete Random Variables
- 3.3 Expected Values of Discrete Random Variables
- 3.4 The Binomial Probability Distribution
- #3.5 Hypergeometric and Negative Binomial Distributions
- 3.6 The Poisson Probability Distribution

Chapter 4: Continuous Random Variables and Probability Distributions [2 Weeks]

- 4.1 Probability Density Functions
- 4.2 Cumulative Distribution Functions and Expected Values
- 4.3 The Normal Distribution
- 4.4 The Exponential and Gamma Distribution
- #4.5 Other Continuous Distributions (t -distribution and χ^2 - distribution (Additive property only))
- #4.6 Probability Plots

Test 1 [Chapters 1 – 4]: Thursday, October 4, 2018

Chapter 5: Joint Probability Distributions and Random Samples [1.5 Weeks]

- 5.1 Jointly Distributed Random Variables
- 5.2 Expected Values, Covariance, and Correlation
- 5.3 Statistics and Their Distributions
- 5.4 The Distribution of the Sample Mean
- 5.5 The Distribution of a Linear Combination

Chapter 6: Point Estimation [1 Week]

- 6.1 Some General Concepts of Point Estimation
- 6.2 Methods of Point Estimation

Chapter 7: Statistical Intervals Based on a Single Sample [2 Weeks]

- 7.1 Basic Properties of Confidence Intervals
- 7.2 Large-Sample Confidence Intervals for a Population Mean and Proportion
- 7.3 Intervals Based on a Normal Population Distribution
- 7.4 Confidence Intervals for the Variance and Standard Deviation of a Normal Population

Chapter 8: Tests of Hypotheses Based on a Single Sample [2 Weeks]

- 8.1 Hypothesis and Test Procedures
- 8.2 Tests about a Population Mean
- 8.3 Tests concerning a Population Proportion
- 8.4 P-Values
- 8.5 Some Comments on Selecting a Test

Test 2 [Chapters 5 – 8]: : Thursday, November 15, 2018

Chapter 9: Inferences Based on Two Samples [2 Weeks]

- 9.1 z Tests and Confidence Intervals for a Difference between Two Population Means
- 9.2 The Two-Sample t Test and Confidence Interval
- 9.3 Analysis of Paired Data
- 9.4 Inferences Concerning a Difference between Population Proportions
- 9.5 Inferences Concerning Two Population Variances

#Chapter 10: The Analysis of Variance

- 10.1 Single-Factor ANOVA

#Chapter 12: Simple Linear Regression and Correlation

- 12.1 The Simple Linear Regression Model
- 12.2 Estimating Model Parameters
- 12.3/4 Statistical Inference for Simple Linear Regression Parameters
- 12.5 Correlation

#Chapter 14: Goodness of fit and Categorical Data Analysis

- 14.1 Goodness-of-Fit Tests When Category Probabilities are Completely Specified
- 14.2 Goodness of Fit for Composite Hypotheses
- 14.3 Two-Way Contingency Tables

#: These chapters may not be covered, unless there is enough time.